

Demand and Supply Situation for Medicinal Plants

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Abstract— From 2020 to 2015, it was predicted that the demand for medicinal plants in India will increase at an annual pace of between 17 and 23 percent to meet the needs of both domestic and international consumers. Small-scale farmers stand to gain financially and economically from a well-organized medicinal plant production and administration system. Ayurveda, Unani, and Siddha are the three main Indian medical traditions, and together they are expected to bring in more than \$500 million annually. In 2015, the gap between demand and supply of MAPs was predicted to be between 50,000 and 250,000 tons. In 2020, this hole was predicted to grow from 250,000 to 500,000 metric tons. Modified accelerated production (MAP) industries provide labor opportunities in economically depressed states, raising the standard of living and tax base of the area.

Keywords— Demand, Supply, Medicinal Plants, Growth, Economically

I. INTRODUCTION

Ethnobotany is the scientific study of the traditional medicinal and spiritual uses of plants in various human societies. Indigenous peoples have been honing their own bodies of knowledge on land management, political organization, and environmental security since the birth of mankind. Recent studies have shown that around a quarter of today's medications come from the study of medicinal plants and their extraction. Seventy percent to ninety percent of the world's population, mostly in underdeveloped countries, uses herbal treatments to treat illness. However, in developing countries, attempts to expand access and introduce new technologies remain severely constrained. Furthermore, people in some impoverished countries are forced to seek for inexpensive and culturally traditional medicinal herbs due to the excessive pricing of pharmaceutical medications. Indigenous knowledge is the outcome of people's long-term engagement with their local ecosystems. Considering this, it is clear that ethnos botanical research is useful

for documenting, analyzing, and disseminating information about the complex link between biodiversity and human civilization. It reveals the ways in which human actions affect and are affected by natural diversity.

Due to its direct and considerable involvement with this topic, ethnobotany plays a critical role in helping the development of correct information on the usage of both wild and cultivated plant species. Plants serve many functions around the globe, including but not limited to food, fodder, medicine in tablet form, textiles, housing, agricultural implements, hunting accessories, medications, poisons, gums, colors, fuel, fibers, currency, and religious practices. India's wide range of conservation, edaphic, and climatic circumstances help to explain the country's abundance of flora and fauna. When it comes to treating a broad variety of illnesses in both people and cattle, medicinal plants continue to play an important role despite the fact that they are in short supply and subject to environmental stresses. As reported by the WHO in 2011, traditional healers serve as a primary

source of treatment for about 80% of the rural population in developing nations. There is a worrisome reliance on traditional medicine in nations experiencing expansion. At any one-time, multiple cultures have relied on around 25 percent of the world's senior plant taxa for medicinal purposes.

II. LITERATURE REVIEW

Santos, Maura & Chandran, Deepak (2023) Research into natural goods has reached a new level of depth and breadth in recent years. Its relevance and extensive application are shown by its use in several academic fields, including as studies aiming at gaining a deeper knowledge of and reaping the benefits of biodiversity. The economic interest, which aims at the use of these metabolites in the production of perfumes, dyes, medicines, and pesticides, must be balanced with the scientific knowledge that contributes to the development of several areas of science, including pharmacology, botany, organic chemistry, evolution, and chemical ecology. With a focus on plant resources, bioprospecting, adding value to biodiversity's products, biological activities, essential oil, the seasonality effect, socioeconomic approaches, and some future prospects were discussed in this chapter as they pertain to the sustainable use of medicinal plants from a conservationist's point of view.

Hidayat, Syamsul & Subositi, Dyah (2023) Medicinal plants are one of the most valuable biological resources available to humanity. The use of plants in medicine is on the rise, both in conventional and alternative settings, and with the help of new and old technology. The unfortunate corollary to this progress is an increase in the threats to the survival of medicinal plants in their natural settings. Therefore, it is imperative that medicinal plants be preserved, and it is important that any efforts to do so be consistent with technological development. One approach to protecting medicinal plants is to create a thorough scientific database. The scientific database has the potential to not only avoid the loss of information on medicinal plants, but also to encourage the preservation and responsible use of this information. Numerous databases have been established all across the world. In this section, we take a look at a variety

of database resources that might be useful in creating a database to preserve medicinal plants.

Nazari, Mansoureh & Kordrostami, Mojtaba (2023)

There has been a huge surge in interest in growing and utilizing medicinal plants recently. Medicinal plants have been an integral element of folk medicine for thousands of years around the globe. The loss of biodiversity and the degradation of ecosystems have been accelerated by human activity, especially the desire for plants used in medicine. Therefore, safeguarding threatened medicinal plants is an urgent need. Several methods were used to ensure the long-term survival of medicinal plants. One option that has shown promise for achieving this goal without significantly altering the fundamental properties of plants is biotechnology. The science of biotechnology offers a number of options for ensuring the continued existence of these plants. Tissue culture is considered by many to be a crucial technique. A full plant may be grown from a single leaf, bud, stem, or other piece that has undergone tissue culture. Plants can do this because, unlike mammalian cells, they can divide, specialize, and eventually create the complex organism that is a plant. Because of advancements in tissue culture, it is now possible to rapidly multiply identical plant populations. The conservation of important germplasm resources and native or endangered plant species may benefit from the use of plant tissue culture. In this chapter, we'll look at the many ways that tissue culture has been used to conserve medicinal plants for the future.

Shukla, Sandeep (2023) Medicinal herbs have been used by humans as a primary method of treatment and prevention since prehistoric times. However, many species have been lost to extinction due to human activities such as the degradation of habitat and the use of non-sustainable harvesting practices for medicinal plants. This research paper delves into the challenges and possible rewards of medicinal plant preservation. In this post, we'll take a look at the threats these plants face, why it's so important to keep them around, and what can be done to ensure they stick around for the long haul. The immense variety of medicinal plants may be preserved, along with the invaluable benefits they bring to human health, provided the challenges and opportunities facing this sector are confronted and used.

Leaman, Danna (2020) North America is home to more than 2,000 unique plant species, many of which are used for fragrance or medicinal purposes. The Albuquerque Bio Park is working with the IUCN Medicinal Plant Specialist Group and NatureServe to assess the species' current conservation status and provide an update. Protecting species and ecosystems, engaging in sustainable wild harvesting, and producing plants where suitable are all goals of the IUCN Plants for People initiative. Assessing the current state of conservation is an important step toward this goal.

MEDICAL PLANT DEMAND AND SUPPLY POSITIONS

Much of the plant world consists of medicinal and aromatic plants, which are very important because they provide essential raw ingredients for the pharmaceutical, cosmetic, and healthcare industries. India's traditional medical system, which has developed over many centuries, makes use of a broad variety of plants with therapeutic properties. Ayurveda, Siddha, Unani, and other traditional practices are all included under this umbrella term. Over 9,000 native plant species have been catalogued for their therapeutic properties, and another 1,500 for their fragrant and delicious qualities. An estimated 80% of the population in developing countries uses traditional plant-based medicines to meet their healthcare requirements, according to research by the World Health Organization. Many modern medications get their active ingredients from plants, which makes them a feasible choice for treating a variety of conditions. Many people have easy access to them, they have few negative consequences, are very inexpensive, provide ecological benefits, contain around 40 percent of the world's biodiversity, and are home to some extremely rare species. Medicinal and aromatic plants make up a significant amount of the flora in these areas and are thus vital resources for the pharmaceutical, cosmetic, fragrance, taste, and associated industries.

Importance of the Medicinal Crops

India is known for its abundance of plant species with medicinal and aromatic properties. More than 1,100 different plant species are used in the Indian system

of medicine. Around sixty kinds of these plants are highly sought for and are frequently picked from forests. The derivative chemicals of medicinal and aromatic plants are well-known for their curative capabilities and absence of bad effects, which may explain the rising demand for these plants in both developing and developed countries. As a result, the market for therapeutic herbs has exploded. The extant trade data shows that the global market for medicinal plants is both quite large and has been growing rapidly in recent years. According to the study conducted for the World-Wide Fund for Nature, the total import of "vegetable materials used in pharmacy" into the European Economic Community in 1980 was 80,738 tons. With a total of 10.05 metric tons of plants and 14 metric tons of vegetable alkaloid and its derivatives, India emerged as the largest provider. The two most prominent countries exporting medicinal plants are India and Brazil. It is estimated that the market for Indian medicinal plants is worth Rs.550 crore. The global industry for cosmetics and aromatherapy might benefit greatly from the use of extracts made from Indian medicinal plants, especially essential oils. There is a lot of money to be made in the medicinal and aromatic plant industry since there is a seven percent yearly growth rate in the worldwide demand for herbal products.

It is now generally accepted that medicinal and aromatic plants contribute significantly to the global economy and human wellness. However, assessing the value of these resources, both locally and globally, is complicated by the scarcity of trustworthy data on the species in question. This data covers how they are used, where they may be found, how they are gathered or harvested, how they are grown, how much of them are produced, and how they are traded. The industry, like the State-run systems, is cloaked in secrecy. While most of the information we have comes from anecdotal reports, there has been an increased focus in recent years on methodically collecting data on these many factors. Several nations' assessments, as well as global reports such as Husain's (2006) research on the global trade, marketing, and consumption of essential oils and McAlpine et al.'s (2007) forecast of these variables, have been published. The demand for medicinal plants has skyrocketed in the international commerce sector in recent years. The direction of trade, from developing to developed countries, is a

defining feature of this economic phenomena. The phenomena contribute positively to income equality. The economies of India and China are often regarded as the world's two most powerful trading powers. The total value of trade has increased significantly over the last decade, from \$52.8 million to \$68.7 million, a rate of growth of 3.56% each year. There is no way to know for sure whether we have even scratched the surface of the market for therapeutic plants. The present level of engagement in the program is still far below the real capacity of the countries involved. However, Least Developed Countries (LDCs) have some prospective openings to increase their exports of therapeutic crops. The worldwide market for herbal medicine was estimated to be worth more than US \$68.7 billion in 2012 by the Food and Agriculture Organization (FAO).

Table 1 Annual Demand for Prioritized Medicinal Plants
– India

Crops	Demand (Tonnes)		Annual Growth Rate (%)
	2021-12	2014-15	
Amla	22730	41783	22.5
Andrographis	2015	2197	3.1
Ashwagandha	7029	9128	9.1
Asoka Tree	7051	10724	15
Atis	270	448	18.4
Bacopa	3823	6622	20.1
Bael Tree	5381	7085	9.6
Black Nightshade	2078	2192	1.8
Chitra	965	1285	10
Chlorophytum	38	61	17.2
Costus	1414	1826	8.9
Elamelily	65	101	15.4
Guggul	1505	2549	19.2
Holy basil	3297	5403	17.9
Indian aconite	322	3427	30
Indian barberry	1187	1829	15.5
Indian tinospora	2258	2933	9.1
Jatmansi	675	867	8.7
Liquorice root	873	1360	15.9
Long pepper	3993	6280	16.3
Phyllanthus amarus	2213	2985	10.5
Picrorhiza	220	317	12.9
Rauwolfia	424	589	11.6
Sandalwood	635	1073	19.1
Sen N/A	6463	11677	21.8
Shatavari	10925	16659	15.1

World Trade in Medicinal Plants

In 2001, international trade was valued at US\$1135m, but by 2012, it had dropped to US\$1034. During this time period, annual growth rates ranged from 5% to 15% across the board. It is anticipated that the market for this sector of the economy grew at an annualized pace of 25 percent between 2000 and 2007. Industrialized countries like Europe and the United States have strict regulations on natural medicines. It's common knowledge that these nations have stringent requirements for the quality of goods that may be

imported into their borders. This is a major barrier for emerging and LDC countries to enter these markets, especially for those whose products have not been subjected to extensive testing. The ever-increasing interest in medicinal plants all around the globe has created a constant market for them. However, at the same time, illegal trades in plant components have led to the careless collection of wild plant species, posing a serious threat to biodiversity.

Table 2 World Export Value of Medicinal Plants

Countries	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	1135.8	1297.4	1176.4	1395.5	1525.1	1406.4	1320.9	1223.5	1102.4	1097	1061.2	1034.4
USA	100.5	137	115.2	119	125	120.3	119.5	104.1	106.7	108.3	78.9	74.1
EU	163.1	181.7	165.5	189.5	215.1	186.6	188.2	203.2	185.7	180.9	169.9	177.4
Germany	66.1	75.7	69.5	65.6	75.1	77.5	76.6	76.3	65.6	55.5	53	56.7
China	208.3	238.5	235.8	410.1	415.4	327.8	238.4	238.4	211.9	216.5	199.7	215.3
India	52.8	55.1	40.7	52.2	65.7	66.9	63.9	63.9	44.2	79.5	78.6	68.7
Africa	33.7	34.4	28.5	34.7	40.9	49.4	45.4	45.4	44.9	40.6	37.4	49.8

Table 3 World Exports volume of Medicinal Plant

Countries	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
World	371.9	406.4	421.1	449.4	463.1	489.0	497.5	463.7	478.0	529.1	541.4	583.6
USA	7.7	10.0	11.4	13.2	12.9	14.0	14.4	17.4	15.9	18.0	16.2	12.6
EU	32.3	34.6	35.1	39.0	54.1	38.7	45.9	44.1	40.7	40.2	39.7	47.6
Germany	14.4	14.2	14.0	14.6	16.5	15.5	16.5	16.5	16.1	14.3	13.6	14.2
China	99.0	113.3	126.0	155.4	142.5	165.0	165.2	143.1	165.2	186.4	169.2	150.3
India	37.8	36.1	31.3	37.6	37.6	35.8	41.1	42.6	38.8	47.8	49.1	45.8
Africa	16.4	18.9	19.3	26.8	28.2	33.2	36.8	34.9	36.8	33.4	33.4	39.4

Data on commercial activity is incomplete since most of it goes unreported. Either those in charge of compiling statistics are unable to recognize subtle differences between plants, or they fail to separate medicinal from recreational use. Documented exports of medicinal plants from LDCs peaked at US \$37 million in 2018, according to the Food and Agriculture Organization (FAO), before falling to US \$27 million the following year. From 2005 through 2009, the average yearly amount was close to \$31 million in the United States. The market for medicinal, aromatic, and exotic plants has not yet reached its full potential, but the business is still in its early phases in a number of promising nations. According to the data in the table, the total value of exported Ayurvedic and Unani

pharmaceuticals is close to Rs.300 million. Ayurvedic pharmacies spend over 70% of their entire raw material budget on therapeutic plants. Since herbal medicines are becoming more popular in both the domestic and international markets, it stands to reason that there would be an equal and opposite growth in the demand for medicinal plants. Sunitha (2014) reports that the demand for Ayurvedic medicines in the Indian state of Kerala is expected to expand at a CAGR of 10% to 12% over the next several years. There are also signs that the use of complementary and alternative medicine is on the rise all around the globe. The Centre for Monitoring the Indian Economy (CMIE) estimates that India's exports of plant-based medicines and pharmaceutical commodities in 2016–2017 were worth roughly Rs.2,800 million. About \$16 billion is traded yearly in the international trade of medicinal plants, which are obtained from forests as NTFPs.

Table 4 India's Exports of Medicinal Plants and Herbal Products

Particulars	2018-09	2019-10	2020-11	2021-12	Major Destinations
Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fungicidal or similar purpose, fresh or dried, whether or not cut, crushed or powdered	268.74	191.44	357.45	370.94	USA, Japan
Vegetable saps and extracts, pectic substances, pectinates, and pectates; agar-agar and other mucilage's and thickeners, whether modified, derived from vegetable products Preparations	826.79	921.53	698.99	593.18	USA
Ayurvedic and Unani Medicines	34.76	36.23	96.53	92.26	USA, Russia
Homoeopathic Medicines	0.37	0.67	2.19	2.03	Sri Lanka
Ayurvedic and Unani Medicines for retail sales	98.94	108.79	124.97	147.52	USA, Russia
Homoeopathic medicines for retail sales	1.33	3.19	8.96	3.73	Ivory Coast, USA
Total	1230.8	1261.9	1289.1	1209.7	
Growth per cent per annum	—	2.5	2.2	-6.2	

Table 5 Export of Major Medicinal Plants from India (2020-11)

S. No.	Medicinal Plant/part	Quantity (in Tonnes)	Value (Rs. In lakhs)
1	Liquorice roots (fresh/dried/powdered)	54.9	70.53
2	Nux vomica	1.8	17.97
3	Galangal (rhizomes and roots)	108.6	33.45
4	Ginseng roots	3271	1345.6
5	Agarwood	169	45.1
6	Belladonna leaves	1.7	84.63
7	Belladonna roots	2304.6	331.8
8	Poppy flowers and unripe heads	9.4	18.4
9	Poppy husk	1	0.43
10	Isabgol (husk)	19.27	20093.8
11	Isabgol (seeds)	1000.4	746.8
12	Senna (leaves and pods)	7430.25	1839.97
13	Tukmaria	97.7	49.6
14	Catharanthus roseus	522.9	189.31
15	Neem (seed)	106.5	38.64
16	Neem (leaves/powder)	13.13	6.81
17	Gymnema (powder)	19.99	110.9
18	Ayurvedic and Unani herbs	9367.12	2250.26

Table 6 Asian Trade in Essential Drugs in 2019

Country	Export to world (US \$ thousand)	Intra-regional exports (in % of exports to the world)	Imports from World (US \$ thousand)	Intra-regional imports (in % of imports from the world)
Bangladesh	3137	15.8	21599	26.4
Cambodia	41	0	26738	20.3
	179893	18.5	557970	1.1
India	692957	14.7	113006	6.1
Indonesia	17639	57.1	43316	5.4
Sri Lanka	570	13.7	76439	6.4

In Western countries, you may buy several pharmaceuticals without a doctor's prescription. The botanical components listed as basic ingredients are included in the aforementioned pharmaceutical medicines, albeit they are not always accessible in the same presentation as Ayurvedic therapies inside the Indian Medical Systems. They are often used off-label. Materials for the manufacture of these therapeutic compounds come, in large part, from developing countries in an unprocessed form. The total worth of the business created via this method is close to \$800 million.

Table 7 Over counter Drugs Used in Western Countries

No.	Common Name	Botanical Name	Use	Business (US \$* 10 ⁶)
1	Psyllium	Plantago ovata	Bulk laxative	250
2	Ginkgo	Ginkgo biloba	Memory enhancer	138
3	St. John worts	Hypericum perforatum	Antidepressant	121
4	Garlic	Allium sativum	Hypolipidemic	84
5	Aloe	Aloe spices	Stimulant laxative	52
6	Peppermint	Mentha piperita	Antitussive	40
7	Saw-palmetto	Senecio repens	Prostrate Hyperplasia	30
8	Ginseng	Paraax spices	Brain	12
9	Mandhukaparni	Centella asiatica	Blood circulation	12
10	Black cohosh	Cimicifuga racemosa	Menopause	10
11	Kava	Piper methysticum	Permanent syndrome	8
12	Milk thistle	Stylybum marianum	Antidepressant	8
13	Valerian	Valeriana officinalis	Live protection	8
			Calmative	8

There has not yet been a thorough establishing of the current corpus of information about crops, agricultural methods, demand patterns, and market shares. The largest distributors in the medical plant trade often purchase many botanical species, sometimes from different suppliers that provide materials of various quality. The unreliable availability of raw materials contributes to the market's immaturity. There is a wide range in the cost of pharmaceuticals, and the amount of active ingredients in any particular product will vary according on the reliability of the supplier. Frequent rejections of export shipments are common, and the negative externalities associated with them are typically exaggerated. As a result of this phenomena, the net money obtained by collectors and farmers of medicinal crops is very variable. Zandu, Himalaya Drugs, Baidyanath, Dabur, Natural Remedies, Charak, Kottakal, Kerla Ayurvedic Pharmacy,

Dhootpapeswar, and many more are only few of the major buyers in the home market. The rising demand for medicinal plants has resulted in an extraction rate from natural (wild) sources that now exceeds their regeneration rate. Unchecked and unregulated harvesting practices, which don't take into account the resource's long-term sustainability or preservation, may be to blame for the observed behavior. Because of this phenomenon, availability will always be limited. *Aconitum heterophyllum*, *Aegle marmelos*, *Withania somnifera*, *Coscinium fenestratum*, and *Swertia chirayatha* are only few of the therapeutic plants where this phenomenon has recently been seen.

III. CONCLUSION

Between 17 to 23 percent yearly rise in demand for medicinal plants in India, to serve both domestic and international markets, was predicted between 2020 and 2015. Small-scale farmers stand to gain financially and economically from a well-organized medicinal plant production and administration system. Ayurveda, Unani, and Siddha are the three main Indian medical traditions, and together they are expected to bring in more than \$500 million annually. In 2015, the gap between demand and supply of MAPs was predicted to be between 50,000 and 250,000 tons. In 2020, this hole was predicted to grow from 250,000 to 500,000 metric tons. Modified accelerated production (MAP) industries provide labor opportunities in economically depressed states, raising the standard of living and tax base of the area.

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